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22. OBSERVATIONS ON STRANDED GREEN TURTLES, *CHELONIA MYDAS*, IN THE GULF OF KUTCH

Although the green turtle, *Chelonia mydas* (Linn.), has been reported from the Gulf of Kutch by Bhaskar (1978), little has been recorded about the biology of this population. This note reports a few observations on stranded individuals from this area in the hope that this may stimulate further, more detailed study.

On 5 January 1987 a female (JGF 5135) was found dead on the east side of Bet Dwarka Island, south of Hanuman Point (approx. 69° 8' 48" E, 25° 27' 48" N), about 7.5 km east of Okha. Standard measurements (in cm) include: curved carapace length (CCL) = 100; curved carapace width (CCW) = 92; straight carapace width (SCW) = 69; plastron length (PL) = 76; supracaudal notch (SCN) = 0.0; and head width (HW) = 13.5. Scallation was normal: viz. 5 vertebrals; 4 left/4 right pleurals; 11/11 marginals; 1/1 supracaudals; 1 cervical; 4/4 postoculars; intergular moderate; 6 pairs of plastral scutes (gular through anal); and 4/4 inframarginals. There was no sign of injury, but a population notch was conspicuous on each 'shoulder': large on the right and moderate on the left.

The left ovary had: approximately 60 yellow follicles about 15 mm in diameter; about 15 grey follicles of irregular shape and size; at least 60 *corpus lutea*; at least 100 *corpus albicans* (or very small ova); and 3 large 'watery' follicles. There was no sign of enlarged yellow follicles or of oviducal eggs.

Total contents of the stomach weighed 5 kg. A subsample revealed 4 dominant species of algae; in order of importance they were: *Caulerpa scalpelliformis*, *Gelidialla acerosa*, *Ulva lactuca*, and *Laurencia pedicularoides*. Nine other algae occurred as incidental components: *Champia indica*, *Caladophora glomerata*, *Dictyopteris australis*, *Dictyota dichotoma*, *Halymenia venusta*, *Hypnea musciformis*, *Myriogloea* sp., *Soleiria robusta* and *Spatoglossum variabile*. *Caulerpa scalpelliformis* constituted 60 to 70% of the total by volume (identifications by Dr M S Murthy). (G. Balazs [in litt., 5 Dec. 1988] points out that *Gelidialla acerosa* may be confused - by turtles as well as by people - with *Pterocladia capillacea*.)

Epizoa on the carapace were diverse: green and red-brown filamentous algae; calcareous red algae; cocoons of *Ozobranchus* sp. (leech); and at least three species of barnacle - *Chelonibia testudinaria*; *Platylepas hexastylus*;

and one unidentified.

On 10 January 1987 the carapace of a *Chelonia mydas* (JGF 5138a) was found behind the ravaged mangroves on the mainland at Ashapura Point, about 20 km southeast of Okha. Standard measurements (in cm) include: CCL = 94; CCW = 83; SCW = 70; PL = 75; SCN = 0.0. Scallation was normal except for some asymmetry in the 4th vertebral and in 2 marginals. The soft tissues had virtually disappeared, but there were some shreds of muscle still clinging to the inside of the shell. No epizoa were seen. There was no sign of the cause of death.

As both carcasses were near the mouth of the Gulf, and strong tidal currents run there, it is not possible to determine whether or not these animals had died inside or outside the Gulf. However, *C. mydas* are commonly seen further inside the Gulf, where there appear to be both nesting and feeding populations (Bhaskar 1978; T. Mundkur, pers. comm.). In this respect, it may be relevant that a group ('flotilla') of at least 20 turtles was seen at Okha, at the southern mouth of the Gulf, on 11 March 1987; they were apparently surfacing and moving together (T. Mundkur, pers. comm.).

Little can be said about specimen JGF 5138a. Its shell measurements are each a few cm below the respective means for females nesting at nearby Hawksbay, Pakistan, but the values are well within the ranges for this population (Kabiraji and Firdous 1984:18).

Specimen JGF 5135 was clearly a female that had recently ovulated. Nesting (evidently by *Chelonia*) occurs on Bet Dwarka, Samini, and nearby mainland beaches (Mundkur in litt., 26 Nov. 1988), as well as on Bhaider Island (Bhaskar 1978; T. Mundkur, pers. comm.), about 15 km east, further inside the Gulf. The oceanic beach at Mithapur, some 20 km west and then southwest of where the carcass was found, is also an area of significant nesting (S. Trivedi, pers. comm.). Unfortunately, next to nothing is documented about these nesting areas, but the peak in egg laying is said to be around the end of the year at Mithapur (S. Trivedi, pers. comm.). *Chelonia mydas* is also reported to nest all along the northern coast of the Gulf of Kutch, notably from September to November (Himmat-sinhji in litt., 9 Jan. 1987).

A major nesting population of *Chelonia mydas* has

been studied at Hawksbay, Karachi, Pakistan, for nearly a decade (Kabiraji and Firdous 1984). Nesting occurs round the year, with a peak in numbers during November, and it has been suggested that 6,000 females nest here in a year. This beach is about 350 km northwest of Bet Dwarka, and although it is much farther away than are the sites in or near the Gulf, the fact that a very large number of *C. mydas* nests there makes Hawksbay a likely source of turtles for the Gulf of Kutch.

Nonetheless, the only way to confirm the source of the Kutch turtles is through recaptures of tagged individuals. The project at Hawksbay, run by the Sind Wildlife Management Board, has to date applied over 1,000 tags to turtles (Kabiraji *in litt.*, 17 July 1988), but as yet there is no report of a long-distance recovery. (There do appear to be major problems with tag loss at Hawksbay [pers. obs.], which would greatly reduce the chances of international tag returns).

If the animals nesting in, or adjacent to, the Gulf of Kutch, and/or at Hawksbay are feeding in the Gulf of Kutch, this would be an example of a *C. mydas* population that is virtually non-migratory, or that migrates a very short distance. This phenomenon is not thought to be common in this species, although there is an indication that a population off the coast of Zanzibar, Tanzania, may be non-migratory (Frazier 1981).

The algivorous feeding habit of JGF 5135 is remarkable, but consistent with additional evidence from Pakistan. Kabiraji and Firdous (1984:23) recounted reports of divers in the Karachi area watching (and hearing!) *Chelonia* feed on algae attached to rocks. A male *C. mydas* found dead on the Hawksbay beach on 16 June 1986, apparently subadult (CCL = 88.0; CCW = 80.5;), had its stomach packed with bright red filamentous algae (pers. obs.).

The fact that there are dugongs in the Gulf of Kutch, and that a dugong stomach from there was full of *Halophila ovalis* (Frazier and Mundkur *in prep.*), indicates that significant pastures of at least a small marine angiosperm are present in the Gulf. Perhaps the larger angiosperm species, or 'seagrasses', favoured by turtles (e.g. Hydrocharitaceae and Potamogetonaceae: *Cymodocea* spp., *Syringodium isoetifolium*, *Thalassia hemprichii*, and *Thalassodendron ciliata*) do not form significant pastures in this area, and for this reason the turtles specialize on algae, which are abundant in the Gulf (Murthy *et al.* 1978,

Murthy, *pers. comm.*; pers. obs.). In addition, it is generally thought that algae may provide more nutrition for *C. mydas* than do marine angiosperms (Bjorndal 1982; *in litt.*, 22 July 1988). (However, Balazs [*in litt.*, 5 Dec. 1988] finds that *Halophila ovalis* [hawaiiana] is prominent in the diet of *C. mydas* in the Hawaiian region).

It is remarkable that two *Chelonia* were found dead in the Bet Dwarka area within a short period of time, relatively close to each other. In neither case could the cause of death be determined, but the fact that there were no external injuries and that the two animals had succumbed apparently in the same area at about the same time suggests that they had been drowned in trawls working in the Okha area. There is active trawling in this area, and drowning in trawl nets is a major cause of mortality of sea turtles; nearly 12,000 turtles may be drowned each year off the eastern coast of USA (Gordon and Fletemeyer 1984:3-467; Crouse 1982, 1984).

However, there are other probable causes of death by human agencies. The remains of an adult-sized *Chelonia* was found near the Vadinar oil terminus near Jamnagar. It had been cut in half transversely behind the front flippers; a ship's propeller was therefore thought to be responsible (Mundkur *in litt.*, 17 March 1987). Large numbers of *Chelonia mydas* wash up dead at Hawksbay, Karachi, from unknown causes; this area is adjacent to a major port with very active ship movement and heavy contamination (pers. obs.).

There is an obvious and pressing need for detailed studies of the Gulf of Kutch, for tagging activities on the Mithapur and Kutch beaches, and for active campaigns to alert local fishermen of the tagging programmes and of the rewards offered for turning in tags. In addition, incidental causes of mortality of turtles should be assessed and reduced as much as possible.

Numerous people helped with information, comments and logistics: G. Balazs, K. Bjorndal, F. Firdous, A. Kabiraji, S. Khachar, L. Khacher, N. Khacher, T. Mundkur, M.S. Murthy, R. Naik, and S. Trivedi. Financial and logistic support was provided by: Hingolghat Nature Conservation Education Programme, Indo-American Subcommittee on Education and Culture, Sind Wildlife Management Board, University Grants Commission, and the U.S. Fish and Wildlife Service.

December 18, 1988.

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23. MORPHOMETRY OF THE INDIAN FLAP-SHELL TURTLE (*LISSEMYS PUNCTATA ANDERSONI*)

Morphometry of the Indian flap-shell has already been described by Smith (1933), Pritchard (1979) and Daniel (1983). The present note contains some additional information based on studies on specimens from the Keoladeo National Park, Bharatpur, Rajasthan, India.

The presence of seven callosities in the plastron is one of the main characteristic features of flap-shells. However, about 5% (34 out of 740 examined) of the turtles in this Park had only six callosities. The one missing was the singular entoplastral callosity and was recorded in smaller individuals with a carapace length (CL) less than 130 mm. Only in 8 cases was it observed in specimens above 130 mm. Flapshell turtles without an entoplastral callosity have also been reported in the past from Rajasthan (Biswas and Sanyal 1977). The size of this callosity seems to bear a relationship to the age and size of the turtle.

Earlier records show that the maximum known carapace length and weight of this species are 275 mm and 4.5 kg respectively. In Keoladeo National Park, instances of carapace length (curvature measurement) exceeding 280 mm were fairly common (25 out of 740 examined)

and the maximum recorded length was 350 mm. The highest recorded weight in this Park was 5.2 kg in summer. This particular specimen was a female and had no signs of developed eggs when examined by probing the inguinal area.

The flap-shell turtle has two pairs of external glands as given by Smith (1933). One pair opens on the lower side of both hyo- hypo callosities of the plastron which is exactly above the cutaneous femoral valve. The other pair opens on either side of the anterior part of the carapace, just above the midline of the forelimb cavity (humeral). The presence of the latter was not mentioned by Auffenberg (1981) while describing the glands of this species. These glands secrete an odorous yellow fluid which, presumably has a defence function, averting the attack of predators at least for a short duration.

I am thankful to Dr. V. S. Vijayan, Project Scientist, BNHS Ecological Research Centre, Bharatpur for encouragement and to Mr U. Sridharan.

December 31, 1988

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24. NEW LOCALITY RECORD FOR THE INDIAN PINKRINGED TERRAPIN

In July 1988, during my visit to the Patalia Hanuman, on the outskirts of Surat city (21°12'N, 72°52' E) on the bank of the river Tapti and where the river meets the Gulf of Cambay and forms an estuary, I saw a freshwater turtle basking on the dry mudflats, about 3 m away from the river. I captured the turtle and it was identified as an Indian Pinkringed terrapin, *Kachuga tentoria*

circumdatta. The description and other details are given below.

Measurements & Weight: Carapace length 96.0 mm, carapace width 81.0 mm, plastron length 71.9 mm, body height 43.3 mm and weight 85.0 g.

Description: Carapace olive brown with a light pink ring around pleuro marginal junction. Carapace elevated